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ABSTRACT

This guide outlines the topics of instruction and goals/objectives of a half-unit shop/laboratory course in agricultural electronics (Agriscience 324) that is part of Texas' secondary-level agricultural science and technology program. Presented first are lists of the essential elements common to all agricultural science and technology courses offered by Texas public schools, the essential elements specific to Agriscience 324, and catalog numbers of Instructional Materials Service (IMS) curriculum materials pertaining to the course's topics/subtopics. The remainder of the guide lists the objectives to be met upon completion of each of the following course topics along with the corresponding IMS materials: basic principles of electricity, magnetism, and electromagnetic induction; operation/safe use of tools and mechanical, electrical, and electronic test equipment; electron and hole theory of current flow as related to semiconductors, electronic components, integrated circuits, and microprocessors; principles of electronic sensing, measuring, controlling, actuating, processing, displaying, and data storing devices and their integration in various agricultural applications; application of appropriate schematics, manuals, troubleshooting techniques, and test equipment to analyze, install, diagnose, service, and/or repair electronic equipment; and plan/conduct leadership activities related to agricultural electronics. (MN)

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CURRICULUM GUIDE

FOR

AGRISCIENCE 324

AGRICULTURAL ELECTRONICS

DEVELOPED

BY

INSTRUCTIONAL MATERIALS SERVICE

DEPARTMENT OF AGRICULTURAL EDUCATION

TEXAS A & M UNIVERSITY

COLLEGE STATION, TEXAS

IN

COOPERATION WITH

TEXAS EDUCATION AGENCY

CAREER AND TECHNOLOGY EDUCATION

AGRICULTURAL SCIENCE AND TECHNOLOGY EDUCATION

AUSTIN, TEXAS

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Dr. Steve Searcy, Texas A&M University, College Station

Dr. Glenn Shinn, Texas A&M University, College Station

Dr. Lon Shell, Southwest Texas State University, San Marcos

Dr. Bill Zingery, Texas A&M University, College Station

TEXAS EDUCATION AGENCY

Lionel R. Meno, Commissioner of Education

Lorraine R. Merrick, Senior Director
Career and Technology Education

Kirk Edney, Director
Agricultural Science and Technology

S. Neil Jeter, Occupational Education Specialist
Agricultural Science and Technology

Rebecca Rhodes McClinton, Occupational Education Specialist
Agricultural Science and Technology

USING THE

CURRICULUM GUIDE

FOR

AGRISCIENCE 324 - AGRICULTURAL ELECTRONICS

Pages 1 through 2 of this guide list the essential elements common to all agricultural science and technology courses. Essential elements specific to Agriscience 324 are listed on page 3.

Pages 5 through 8 contain a list of units and topics of instruction and suggested time allocations for each unit and topic. The periods of instruction listed for each unit and topic are for a one-half unit semester course.

Also listed are catalog numbers of Instructional Material Service (IMS) curriculum materials that teachers may use in teaching the topics and satisfying the essential element requirements. More than one suggested item of curriculum materials may be listed for effective instructional presentation on some topics.

The final section (pages 9 through 20) in the guide provides topic goals and objectives to be met upon completion of each topic. Also shown with the topic goals and objectives are the corresponding IMS curriculum materials listed on the units and topics of instruction page. This section should be particularly useful to teachers in preparing lesson plans and selecting materials to meet individual student's needs.

Each student material topic contains a list of references used in its development. If a more detailed presentation of subject matter is necessary, the teacher may acquire some of these references from IMS and/or from the publishers cited in the reference section of each topic.

S_S75.82 Agricultural Science and Technology/Agricultural Business

(a) The elements in this subsection are common to all agricultural science and technology courses unless otherwise indicated and shall be included in each course at the appropriate level. Every school offering agricultural science and technology shall provide courses which include the following essential elements:

(1) Leadership concepts and skills. The student shall be provided opportunities to:

(A) demonstrate skills, characteristics and responsibilities of leaders and effective group members;

(B) demonstrate a knowledge of parliamentary procedure principles;

(C) plan and conduct leadership activities; and

(D) prepare for effective citizenship and participation in our democratic society.

(2) Concepts and skills related to successful employment and/or post secondary training. The student shall be provided opportunities to:

(A) identify employment opportunities and preparation requirements in chosen field;

(B) identify effective methods to secure and terminate employment;

(C) demonstrate effective communication skills both oral and written and follow through on assigned tasks;

(D) demonstrate dependability and punctuality;

(E) demonstrate productive work habits and attitudes;

(F) understand the importance of taking pride in the quality of work performed;

(G) recognize the dignity in work;

(H) develop skills in planning and organizing work;

(I) apply required methods and sequences when performing tasks;

(J) apply principles of time management and work simplification when performing assigned tasks;

(K) identify ethical practices and responsibilities; and

(L) understand the importance of the application of organization policies and procedures.

(3) Concepts and skills associated with entrepreneurship. The student shall be provided opportunities to:

(A) identify opportunities for business ownership;

(B) understand the risk and profit motive factor;

(C) understand the elements and advantages of the free enterprise system; and

(D) explain the role of small business in the free enterprise system.

(4) Concepts and skills related to safety and safe working conditions. The student shall be provided opportunities to identify and apply safe working practices to all training situations.

(5) Concepts and skills associated with human relations and personality development. The student shall be provided opportunities to:

(A) understand the importance of maintaining good health and proper appearance for effective job performance;

(B) understand oneself and others;

(C) exercise self-control;

(D) accept and use criticism;

(E) recognize basic human relationships as they relate to business success; and

(F) demonstrate characteristics for successful working relationships.

(6) Concepts and skills related to personal and business management. The student shall be provided opportunities to:

(A) explain how management assists in reaching personal and family goals;

(B) explain the management process;

(C) describe the role of management in controlling stress;

(D) identify and understand personal checking accounts;

(E) identify and understand personal loan application processes;

(F) identify and understand different financial institutions;

(G) identify the role and functions of business management;

(H) understand the lines of authority; and

(I) identify effective supervisory techniques.

(7) Concepts and skills related to supervised agricultural activities. The student shall be provided opportunities to plan and conduct/perform supervised agricultural activities.

Agricultural Science 324 - Agricultural Electronics (1/2 unit) shall be a shop/laboratory-oriented course. The course includes the essential elements related to agricultural electronics. The course is designed to reinforce and extend students' knowledge of mathematical and scientific principles and concepts involved in producing and controlling electronic impulses, and to provide them with generic workplace skills relevant to electronic applications in agriculture. The student shall be provided opportunities to:

(1) examine basic principles of electricity, magnetism, and electromagnetic induction;

(2) discuss operation and safe use of tools and mechanical, electrical, and electronic test equipment;

(3) explain electron and hole theory of current flow as related to semiconductors, electronic components, integrated circuits and microprocessing;

(4) describe principles of operation of electronic sensing, measuring, controlling, actuating, processing, displaying, and data storing devices;

(5) discuss integration of electronic sensing, measuring, controlling, actuating, processing, displaying, and data storing systems in various agricultural applications;

(6) apply appropriate schematics, manuals, troubleshooting techniques, and test equipment to analyze, install, diagnose, service, and/or repair electronic equipment;

(7) plan and conduct leadership activities related to agricultural electronics; and

(8) plan and conduct supervised agricultural experience programs, to include personal financial management, and entrepreneurial and career exploration.

AGRISCIENCE 324
AGRICULTURAL ELECTRONICS

Units and Topics of Instruction	Periods of Instruction	Essential Elements	Instructional Materials*
A. Examine Basic Principles of Electricity, Magnetism, and Electromagnetic Induction	10		
1. Electricity and How it is Generated	2	(1)	8798-A
2. Applied Mathematics Review	2	(1)	8798-B
3. Applying Ohm and Kirchoff's Laws	2	(1)	8798-C
4. Resistance and Capacitance in Electrical Circuits	2	(1)	8798-D
5. Applied Magnetism and Electromagnetic Induction	2	(1)	8798-E
B. Discuss Operation and Safe Use of Tools and Mechanical, Electrical, and Electronic Test Equipment	12		
1. Agricultural Mechanics Safety and Laboratory Management Procedures	2	(2)	8600, 8231-B, 8201-A
2. Safe Use of Hand and Power Tools	2	(2)	8412, 8601-A
3. Safe Use of Electrical and Electronic Measurement and Test Equipment	5	(2)	8799-A
4. Desoldering and Soldering Electrical Connections	3	(2)	8799-B
C. Explain Electron and Hole Theory of Current Flow as Related to Semiconductors, Electronic Components, Integrated Circuits, and Microprocessing	6		
1. Operation and Use of Semiconductors	2	(1,3)	8800-A
2. Operation and Use of Transistors and Integrated Circuits	2	(1,3)	8800-B
3. Operation and Use of Photonic-Semiconductor Components	2	(1,3)	8800-C

Units and Topics of Instruction	Periods of Instruction	Essential Elements	Instructional Materials*
D. Describe Principles of Operation of Electronic Sensing, Measuring, Controlling, Actuating, Processing, Display, and Data Storage Devices	14		
1. Use of Electronic Impulse Signals to Transfer Information	3	(1,3,4)	8801-A
2. Operation and Use of Sensors, Switches, and Transducers to Generate Electronic Impulse Signals	3	(1,3,4)	8801-B
3. Operation and Use of Impulse Signal Conditioners, Microprocessors, and Data Storage Devices	3	(1,3,4)	8801-C
4. Operation and Use of Actuators and Displays	3	(1,3,4)	8801-D
5. Operation and Use of Radio Wave, Laser, and Fiber Optic Equipment	2	(1,3,4)	8801-E
E. Discuss Integration of Electronic Sensing, Measuring, Controlling, Actuating, Processing, Display, and Data Storage Systems in Various Agricultural Applications	10	(5)	8802
F. Apply Appropriate Schematics, Manuals, Troubleshooting Techniques, and Test Equipment to Analyze, Install, Diagnose, Service, and/or Repair Electronic Equipment	15	(2,6)	8803
G. Plan and Conduct Leadership Activities Related to Agricultural Electronics	5		
1. Develop Communication Skills	1	(a)(1)(A-D) (a)(5)(A-F) (7)	4850 series 4860 series 8373-A, 8373-D
2. Develop Interpersonal Relations	1	(a)(1)(A-D) (a)(5)(A-F) (7)	8736-B

Units and Topics of Instruction	Periods of Instruction	Essential Elements	Instructional Materials*
3. Develop Qualities of Citizenship and Leadership	2	(a)(1)(A-D) (a)(5)(A-F) (7)	 8003-8004A 8374-A
4. Develop Organizational Skills	1	(a)(1)(A-D) (a)(5)(A-F) (7)	 8742-A
H. Plan and Conduct Supervised Agricultural Experience Programs to Include Personal Financial Management and Entrepreneurial and Career Exploration	8		
1. Explore Entrepreneurial and Career Opportunities in Agricultural Electronics	2	(a)(2)(A-L) (a)(3)(A-D) (a)(6)(A-I) (a)(7) (8)	 8804-A 1050, 2902 8747-A, 8220-A
2. Develop Personal Job Skills	1	(a)(2)(A-L) (a)(3)(A-D) (a)(6)(A-I) (a)(7) (8)	 8372-A
3. Develop Financial Management Skills	1	(a)(2)(A-L) (a)(3)(A-D) (a)(6)(A-I) (a)(7) (8)	 8375-B, 8375-C
4. Develop SAEP Recordkeeping Skills	4	(a)(2)(A-L) (a)(3)(A-D) (a)(6)(A-I) (a)(7) (8)	8001, 8502 8002A, 8002B 8002C, 8002D SAEPG, SAEPJ 324-A, 324-S

* Complete Set of Student Materials for Agriscience 324
(8806 for unbound set) (8806B for bound set)
Gummed Labels for Daily/Weekly Lesson Plans in Agriscience 324 (L324)
Keys to Answers for the Topic Mastery items in 8806 and 8806B (4920)
Pre-Tests/Post-Tests for Topics of Instruction in Agriscience 324 (T324)
Keys to Answers for T324 (K324)
Certificate of Completion for Students Enrolled in Agriscience 383 (90621)

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AGRISCIENCE 324 - AGRICULTURAL ELECTRONICS

UNIT A: EXAMINE BASIC PRINCIPLES OF ELECTRICITY, MAGNETISM, AND ELECTROMAGNETIC INDUCTION

Topic A-1: Electricity and How it is Generated (8798-A)

Topic Goal:

The student shall be provided the opportunity to discuss the theories of energy and atomic structure, and how electricity is generated.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define matter;
2. explain the atomic structure;
3. explain the basic Law of Electrostatic Force;
4. describe the process of ionic bonding;
5. describe the process of covalent bonding;
6. describe the relationships of atoms, elements, compounds, and mixtures;
7. describe what is meant by an insulator;
8. describe what is meant by a conductor;
9. define electricity;
10. explain potential difference and electromotive force;
11. describe the difference between the electron theory and the conventional theory of current flow;
12. list and briefly describe the six methods of generating electrical energy; and
13. demonstrate that changes in electrical energy accompany changes in some other type of energy.

Topic A-2: Applied Mathematics Review (8798-B)

Topic Goal:

The student shall be provided the opportunity to demonstrate the knowledge of basic math as related to calculations in electrical measurement.

Topic Objectives:

After completing the topic, the student shall be able to:

1. discuss the place value, scientific notation, and power of ten methods of writing numbers;
2. discuss the use of metric prefixes to indicate the value of numbers;
3. discuss the function keys on a scientific calculator:
4. work simple electrical measurement problems in algebra, bases, and binary numbers;
5. convert electrical measurement numbers using their equivalent metric prefix; and
6. convert electrical measurement numbers to and from their scientific notation equivalent.

Topic A-3: Applying Ohm and Kirchoff's Laws (8798-C)

Topic Goal:

The student shall be provided the opportunity to explain the relationships between voltage, amperage, and resistance and to apply Ohm and Kirchoff's Laws.

Topic Objectives:

After completing the topic, the student shall be able to:

1. compare the flow of electrical current through a conductor to the flow of a liquid through pipes;
2. define voltage, coulomb, amperage, and resistance;
3. discuss Ohm's Law and describe the relationships between voltage, amperage and resistance;
4. calculate voltage, amperage, and resistance using Ohm's Law;
5. describe power or watts as related to electricity;
6. calculate the amount of electrical energy converted to power or watts using the watts formula;
7. list the three basic types of electrical circuits and describe the characteristics of each; and
8. describe Kirchoff's Law for voltage and current in series and parallel circuits.

Topic A-4: Resistance and Capacitance in Electrical Circuits (8798-D)

Topic Goal:

The student shall be provided the opportunity to explain the effects of resistance and capacitance in electrical circuits.

Topic Objectives:

After completing the topic, the student shall be able to:

1. differentiate between internal and load resistance;
2. describe the purpose of a resistor in a circuit;
3. describe different types of resistors and discuss their operation;
4. describe the resistor color marking system;
5. use the color marking system to determine the resistance of a resistor;
6. define capacitance;
7. describe the operation of a capacitor;
8. discuss factors that affect the capacitance rating of a capacitor;
9. discuss the different functions a capacitor can serve in a circuit; and
10. explain why a capacitor must be discharged before it is safely handled or any test equipment connected.

Topic A-5: Applied Magnetism and Electromagnetic Induction (8798-E)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge of the Laws of Magnetism, and explain the relationships between magnetism and electricity.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define magnetic flux;
2. explain the Laws of Magnetism;
3. describe how an electromagnet and an electromagnetic field are produced;
4. explain the relationship between the direction of current flow and the electromagnetic lines of force;
5. explain permeability, reluctance, and shielding;
6. discuss the factors that effect the strength of an electromagnetic field;
7. define inductance;
8. describe self-induction;
9. describe mutual induction;
10. describe the basic operation of a transformer;
11. describe the basic operation of a solenoid;
12. describe the basic operation of a relay; and
13. describe the basic operation of an electric motor.

UNIT B: DISCUSS OPERATION AND SAFE USE OF TOOLS AND MECHANICAL, ELECTRICAL, AND ELECTRONIC TEST EQUIPMENT

Topic B-1: Agricultural Mechanics Safety and Laboratory Management Procedures (8600, 8231-B, 8201-A)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of safe work practices and laboratory management procedures related to agricultural mechanics and electronics.

Topic Objectives:

After completing the topic, the student shall be able to:

1. describe different types of safety hazards;
2. state and explain laboratory rules and regulations;
3. list steps to follow in case of an accident;
4. discuss the importance of using grounded electrical equipment and ground fault circuit interrupters;
5. describe what to do if someone is receiving an electrical shock;
6. identify universal safety alert symbols, signals, words, and colors;
7. describe what is meant by a "second party accident"; and
8. discuss proper lifting procedures.

Topic B-2: Safe Use of Hand and Power Tools (8412, 8601-A)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and skills concerning the operation and safe use of hand and power tools.

Topic Objectives:

After completing the topic, the student shall be able to:

1. identify and discuss the proper operation of hand and power tools used in the agricultural electronics trade;
2. discuss importance of using the proper tools for the job; and
3. demonstrate proper use and maintenance of common hand and power tools.

Topic B-3: Safe Use of Electrical and Electronic Measurement and Test Equipment (8799-A)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and skills concerning the operation and safe use of electrical/electronic measurement and diagnostic equipment.

Topic Objectives:

After completing the topic, the student shall be able to:

1. identify different types of electrical/electronic measuring and testing equipment;
2. describe the operation of common types of electrical/electronic measuring and testing equipment;
3. demonstrate proper use of analog and digital multimeters;
4. demonstrate proper use of an oscilloscope;
5. demonstrate proper use of a clamp-on ammeter;
6. demonstrate proper use of a logic probe;
7. demonstrate proper use of a power supply unit;
8. demonstrate proper use of a signal generator; and
9. demonstrate proper use of a continuity tester.

Topic B-4: Desoldering and Soldering Electrical Connections (8799-B)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and skills of desoldering and soldering procedures.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define terminology associated with soldering;
2. discuss different types of solder and soldering fluxes, and their applications;
3. explain the importance of using heat sinks when desoldering and soldering;
4. describe the type and size of soldering gun needed in different electronic/electrical applications;
5. explain why the melted solder will not adhere to some surfaces; and
6. demonstrate proper desoldering and soldering procedures.

UNIT C: EXPLAIN ELECTRON AND HOLE THEORY OF CURRENT FLOW AS RELATED TO SEMICONDUCTORS, ELECTRONICS, AND INTEGRATED CIRCUITS, AND MICROPROCESSORS

Topic C-1: Operation and Use of Semiconductors (8800-A)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of how semiconductors operate, and how they are used in individual electronic components, integrated circuits, and microprocessors.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define semiconductor;
2. explain how electrical current is conducted through semiconductors by the movement of free electrons and holes;
3. briefly explain how the doping process is used to create holes and extra electrons in the crystalline structure of certain semiconductors;
4. explain the basic differences and similarities between "electronic" and "electrical" circuits;
5. explain what is meant by a N-type and a P-type crystal;
6. describe the operation of a basic diode;
7. define anode and cathode;
8 explain the reverse bias and forward bias conditions of NP junctions;
9. explain the operation of a zenor diode;
10. describe the operation and use of half and full-wave rectifiers; and
11. explain the purpose of heat sinks.

Topic C-2: Operation and Use of Transistors and Integrated Circuits (8800-B)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of the operation and use of transistors and integrated circuits.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define transistor;
2. compare the characteristics of a transistor to that of a relay;
3. briefly describe the operation of bipolar and field effect transistors;
4. explain transistor gain;
5. discuss the use of thyristors, silicon controlled rectifiers, and triacs;
6. describe a typical hard wired assembly;
7. describe the process of manufacturing printed circuit boards;
8. define integrated circuit and discuss key points of the integrated circuit concept;
9. briefly describe the process of manufacturing an integrated circuit;
10. describe what is meant by a dual in-line package or "dip";
11. discuss the advantages and disadvantages of using integrated circuits; and
12. explain what is meant by hybrid circuits.

Topic C-3: Operation and Use of Photonic-Semiconductor Components (8800-C)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge concerning the operation and use of photonic-semiconductor components.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define photonics;
2. discuss the concept of photons and electromagnetic radiation;
3. describe the operation of light emitting diodes or LEDs;
4. discuss the use of phototransistors, photothyristors, and light-activated silicon-controlled rectifiers;
5. explain the operation and use of solar cells;
6. explain the benefit of connecting solar cells in series and/or in parallel;
7. discuss the operation and use of photoresistor cells; and
8. recognize symbols used to identify photonic components.

UNIT D: DESCRIBE PRINCIPLES OF OPERATION OF ELECTRONIC SENSING, MEASURING, CONTROLLING, ACTUATING, PROCESSING, DISPLAY AND DATA STORAGE DEVICES

Topic D-1: Use of Electronic Impulse Signals to Transfer Information (8801-A)

Topic Goal:

The student shall be provided the opportunity to explain how different types of electronic impulses are used to transfer information.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define electrical impulse;
2. explain the difference between analog and digital electrical impulse signals;
3. explain the terms amplitude and frequency as related to impulse signals;
4. explain the average voltage value of alternating current;
5. measure impulse signals with analog and digital multimeters;
6. define waveform;
7. explain the advantages of being able to measure and observe impulse signals visually with an oscilloscope;
8. read voltage, time, and frequency of different types of waveforms on an oscilloscope;
9. recognize the leading and trailing edges of different types of waveforms on a oscilloscope, and determine the transition or switching time; and
10. explain the binary code system.

Topic D-2: Operation and Use of Sensors, Transducers, and Switches to Generate Electronic Impulse Signals (8801-B)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of the operation and use of sensors, transducers, and switches to generate electronic impulse signals.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define transducer and sensor;
2. explain how a reference voltage type sensor provides an impulse signal to the microprocessor;
3. explain how a voltage generating sensor provides an impulse signal to a microprocessor;
4. identify different types of reference voltage and voltage generating sensors used in the agricultural applications;
5. identify and describe basic types of low-voltage switches used in electronic circuits as sensors to generate impulse signals;
6. describe the use of bar codes, and bar code scanners and readers; and
7. select appropriate sensors, transducers, and/or switches for different applications.

Topic D-3: Operation and Use of Impulse Signal Conditioners, Microprocessors, and Data Storage Devices (8801-C)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of the operation and use of impulse signal conditioners, microprocessors and data storage devices.

Topic Objectives:

After completing the topic, the student shall be able to:

1. explain how the microprocessor receives input data from the sensors;
2. describe the function and operation of impulse signal conditioners;
3. explain how the microprocessor processes input data;
4. explain the operation of an output driver;
5. describe RAM memory;
6. describe ROM memory;
7. describe KAM memory;
8. describe how the microprocessors read and write information to and from memory;
9. explain the operation of logic circuits and basic logic gates;
10. interpret truth tables for basic types of logic gates;
11. discuss the operation of different types of motor driven and electronic circuit timers;
12. explain the operation of open and closed-loop microprocessor systems;
13. explain how microprocessors are capable of storing error and condition codes;
14. explain what is meant by a computer program; and
15. explain the term "artificial intelligence."

Topic D-4: Operation and Use of Actuators and Displays (8801-D)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge and understanding of the operation and use of different types of actuators and displays.

Topic Objectives:

After completing the topic, the student shall be able to:

1. describe how the microprocessor uses its outputs to activate different types of displays and actuators;
2. describe the operation and use of light emitting diode or LED displays;
3. describe the operation and use of liquid crystal displays or LCDs;
4. describe the operation and use of vacuum florescent displays or VFDs;
5. explain how relays and solenoids are used to control other electrical and mechanical functions;
6. describe the operation and use of stepper motors, servomotors, and servovalves to control mechanical and fluid power functions;
7. discuss the operation and use of voice output devices; and
8. discuss the problem of electrical "noise" and its effect on the operation of electronic equipment.

Topic D-5: Operation and Use of Radio Wave, Laser, and Fiber Optic Equipment (8801-E)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge concerning the operation and use of radio wave transmitters and receivers, and laser equipment and fiber optic equipment.

Topic Objectives:

After completing the topic, the student shall be able to:

1. explain what is meant by electromagnetic-radiation radio waves;
2. describe the frequency spectrum assignments used in different types of radio wave communication;
3. define transponder;
4. define scanner or reader;
4. explain the process of transmitting radio waves;
5. explain the process of receiving radio waves;
6. discuss the operation of satellite receivers and transmitters;
7. explain the use of remote wireless controls;
8. explain the operation and use of laser equipment; and
9. describe the operation and use of fiber optic technology.

UNIT E: DISCUSS INTEGRATION OF ELECTRONIC SENSING, MEASURING, CONTROLLING, ACTUATING, PROCESSING, DISPLAY, AND DATA STORAGE SYSTEMS IN VARIOUS AGRICULTURAL APPLICATIONS

Topic: Integration of Electronic Systems in Various Agricultural Applications (8802)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge, skills, and understanding of the integration of electronic sensing, measuring, controlling, actuating, processing, display, and data storage systems in various agricultural applications.

Topic Objectives:

After completing the topic, the student shall be able to:

1. discuss response time as related to electronic systems;
2. define fluid power;
3. describe the four motion control categories of fluid power;
4. discuss applications of electronics in the four motion control categories;
5. discuss the use of electronic/electrical, electrohydraulic, and electropneumatic systems in agricultural applications;
6. identify different component parts used in electronic ignition and fuel injection systems, and briefly explain their operation;
7. identify different component parts used in electrohydraulic, electropneumatic, and electronic/electrical systems, and briefly explain their operation;
8. describe the operation and use a radio frequency identification or RFID systems;
9. discuss the standardization of electronic terminology and component specifications in various applications; and
10. discuss advantages and disadvantages of integrating electronic systems with other types of systems.

UNIT F: APPLY APPROPRIATE SCHEMATICS, MANUALS, TROUBLESHOOTING TECHNIQUES, AND TEST EQUIPMENT TO ANALYZE, INSTALL, SERVICE, AND/OR REPAIR ELECTRONIC EQUIPMENT

Topic: Installation, Service, and Repair of Electronic Equipment (8803)

Topic Goal:

The student shall be provided the opportunity to demonstrate knowledge, skills, and understanding of the use of appropriate component parts, schematics, manuals, troubleshooting techniques, and test equipment to analyze, install, service, and/or repair electronic equipment.

Topic Objectives:

After completing the topic, the student shall be able to:

1. recognize and interpret different types of wiring schematics and ladder diagrams;
2. explain the use of exploded-view component diagrams;
3. recognize and use appropriate component identification letters, connector and circuit numbers, wire size and color codes, icons, and schematic symbols;
4. discuss the purpose of various electrical/electronic standards organizations;
5. apply the formulas from Ohm and Kirchoff's Laws to solve problems related to electrical/electronic circuits;
6. interpret metric and exponent units used in electrical measurements;
7. discuss the different methods of grounding electronic circuits;
8. describe the importance of customer relations and communications in trouble shooting malfunctioning equipment;
9. describe and use logical step-by-step troubleshooting procedures;
10. read and interpret diagnostic flow charts and tree diagrams;
11. discuss the content of operator's manuals;
12. discuss the content of technical service and repair manuals;
13. use appropriate manuals and test equipment to verify operation and diagnose electronic systems;
14. discuss electronic control unit calibration procedures;
15. calibrate an electronic control unit;
16. explain how computer condition and error codes are used to troubleshoot an electronic system;
17. access and interpret condition and error codes from an electronic control unit;
18. discuss importance of not "wiggling" wires during calibration and diagnostic procedures;
19. discuss importance of making proper low-resistance splices and connections in low voltage/current electronic circuits;
20. recognize different types of electronic wiring connections and splices, and discuss their appropriate applications;
21. select repair parts using information listed in manufacturers' catalogs, microfilms, microfiche and/or computers; and
22. install, service and repair basic electronic equipment.

UNIT G: PLAN AND CONDUCT LEADERSHIP ACTIVITIES RELATED TO AGRICULTURAL MECHANICS OCCUPATIONS

Topic G-1: Develop Communication Skills (8373-A, 8373-D, 4850 series, 4860 series)

Topic Goal:

The student shall be provided the opportunity to identify and improve effective oral and written communication skills.

Topic Objectives:

After completing the topic, the student shall be able to:

1. recognize the importance of effective written and oral communication;
2. discuss the different types of oral communication;
3. recognize the part good listening skills will have on effective written and oral communication;
4. identify poor and good speaking qualities;
5. discuss the different types of written communication and their purposes; and
6. list basic steps to follow when writing.

Topic G-2: Develop Interpersonal Relations (8736-B)

Topic Goal:

The student shall be provided the opportunity to learn and develop skills necessary for interpersonal relationships.

Topic Objectives:

After completing the topic, the student shall be able to:

1. explain the reasons for understanding and respecting the views, ideas, and cultural differences of others;
2. describe the importance of establishing a positive self-image and positive image of others; and
3. discuss ways leaders can deal with disturbing behaviors.

Topic G-3: Develop Qualities of Citizenship and Leadership (8374-A)

Topic Goal:

The student shall be provided the opportunity to develop life skills necessary for effective leadership and participate in leadership activities in agricultural mechanics through the FFA.

Topic Objectives:

After completing the topic, the student shall be able to:

1. realize the importance of effective life skills;
2. recognize life skills necessary for effective leadership;
3. evaluate personal life skills acquired;
4. recognize leadership and personal life skills development opportunities; and
5. participate in various activities to further develop leadership skills.

Topic G-4: Develop Organizational Skills (8742-A, 8003, 8004-A)

Topic Goal:

The student shall be provided the opportunity to identify the structure of a group or organization and to recognize different degrees of activity or participation by its members.

Topic Objectives:

After completing the topic, the student shall be able to:

1. define the boundaries of group or organizational membership;
2. discuss means of attracting people to group membership; and
3. describe methods of maintaining group membership and increasing individual participation.

UNIT H: PLAN AND CONDUCT SUPERVISED AGRICULTURAL EXPERIENCE PROGRAMS TO INCLUDE PERSONAL FINANCIAL MANAGEMENT AND EXPLORE ENTREPRENEURIAL AND CAREER OPPORTUNITIES

Topic H-1: Explore Entrepreneurial and Career Opportunities in Agricultural Electronics (8747-A, 8220-A, 8804-A, 1050, 2902)

Topic Goal:

The student shall be provided the opportunity to become familiar with the characteristics of entrepreneurs and to discuss entrepreneurial and career opportunities available in agricultural mechanics related occupations.

Topic Objectives:

After completing the topic, the student shall be able to:

1. discuss factors that motivate entrepreneurs and self-employment;
2. identify characteristics of an entrepreneur;
3. discuss the importance of agricultural mechanics to American and World Agriculture; and
4. discuss different entrepreneurial and career opportunities available in agricultural electronics related occupations.

Topic H-2: Develop Personal Job Skills (8372-A)

Topic Goal:

The student shall be provided the opportunity to understand importance of professional and ethical work habits, and employee-employer and employee-employee relationships.

Topic Objectives:

After completing the topic, the student shall be able to:

1. discuss importance of proper employee-employer relationships;
2. discuss importance of proper employee-employee relationships;
3. list good traits of an employee; and
4. list items that should be provided by a good employer.

Topic H-3: Develop Financial Management Skills (8375-B, 8375-C)

Topic Goal:

The student shall be provided the opportunity to describe the importance of budgeting and personal finance skills and procedures to develop them.

Topic Objectives:

After completing the topic, the student shall be able to:

1. recognize advantages of planning a budget;
2. describe categories of a sample budget;
3. discuss the process of using checking, savings, and credit accounts in personal finances; and
4. secure information on the different types of checking, savings, and credit accounts from financial institutions.

Topic H-4: Develop SAEP Recordkeeping Skills (8001, 8002A, 8002B, SAEP-G, SAEP-J 8502, 8002C, 8002D, 324A, 324S.)

Topic Goal:

The student shall be provided the opportunity to understand the importance of a supervised agricultural experience program and record keeping skills.

Topic Objectives:

After completing the topic, the student shall be able to:

1. recognize the importance of supervised agricultural experience program records as a means of skill development and to explore entrepreneurial and career opportunities;
2. recognize characteristics of a successful supervised agricultural experience program;
3. satisfy state requirements for a supervised agricultural experience program;
4. demonstrate proper recordkeeping skills; and
5. maintain records of the supervised agricultural experience program.

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